PRELIMINARY REPORT ON A PROPOSAL

BY CANAMAX RESOURCES INC.

FOR THE DEVELOPMENT OF A

POTASH MINE AT RUSSELL, MANITOBA

THE CLEAN ENVIRONMENT COMMISSION

DECEMBER 19, 1988

Preliminary Report on a Proposal
by Canamax Resources Inc.
for the Development of a
Potash Mine at Russell, Manitoba

BACKGROUND

On April 8, 1988, Canamax Resources Inc. submitted a proposal to the Environment Department, pursuant to the Environment Act, for the development of a potash mine and milling facility in the Rural Municipality of Russell. Accompanying this proposal was a detailed environmental impact assessment which had been reviewed in detail by a Provincial Technical Advisory Committee, the Interdepartmental Planning Board and the Provincial Land Use Committee of Cabinet.

Section 13 of the Environment Act provides for a license to be issued in stages. A Stage 1 License was issued on September 29, 1988 by the Honourable Ed Connery, Minister of Environment and Workplace Safety and Health. This license stipulated that the environmental license would be issued in three stages, as follows:

Stage 1 - Approval in Principle
Stage 2 - Development and Construction
Stage 3 - Operation

On September 30, 1988, the Honourable Ed Connery requested the Clean Environment Commission to convene public hearings in Winnipeg and Russell and to provide him with recommendations for the content of a Stage 2 Licence by December 15, 1988.

Mr. Connery requested that the Commission's review specifically include, but not be limited to the following considerations:

1. A general review of the adequacy of the Proponent's environmental impact assessment with particular emphasis on:

(a) The adequacy of the Proponent's examination of alternative tailings management methods and the possibility of directing the Proponent to contribute funds to and undertake research in this area.

(b) The need for and the possible timing of the submission of a plan for the long term management and rehabilitation of the tailings area following closure of the operation.

2. Recommendations regarding limits, terms and conditions, if considered necessary, which should be applied to the development and construction phase of the operation.

3. Preliminary recommendations for limits, terms and conditions to be applied to the operational phase of the development.

Mr. Connery also anticipated a further review of the project being conducted prior to the operating phase, at which time a Stage 3 Licence would be issued imposing limits, terms and conditions on the operation.

A copy of the Stage 1 Licence dated September 29, 1988 is attached to this report.

The Commission held hearings in Russell on October 25 and in Winnipeg on October 27 and 28, 1988. The Commission met on December 5 and December 12, 1988 to consider the Canamax proposal and the evidence representations, and argument received at the hearings.

In accordance with Mr. Connery's request, this report provides the Commission's recommendations; however, because of time constraints, the full account of the Commission's hearings is not included in this preliminary report. The balance of the full report, including the evidence, presentations, and argument received at the two hearings held, will be completed and forwarded to the Minister early in the new year.

OBSERVATIONS AND CONCLUSIONS

Kilborn (Saskatchewan) Ltd., the consultant on behalf of Canamax Resources Inc. and the Manitoba Potash Corporation, had compiled a very extensive technical and economic feasability study on the Manitoba Potash Project, including a comprehensive environmental impact assessment. This was presented to the Clean Environment Commission at the Stage 2 hearings at both Russell and Winnipeg on October 25 and 27, 1988 and was the main document for review.

It is clear that the principal environmental concern associated with a potash mine project was the handling, storage and disposal of both brine and mine and mill tailings.

There are approximately 10 potash mines in Saskatchewan employing mining methods similar to that proposed at Russell in similar geological formations. In all cases, approximately two thirds of the mineral that is mined is a waste salt (sodium chloride with some potassium salts and small quantities of insoluble materials such as clay, gypsum and anhydrite). In all cases, the waste salt and brine are stored on the surface of the ground and precautions are taken to prevent the migration of brine to aquifers or surface drains. Some of the saturated waste brine is returned to underground geological formations such as the Winnipegosis formation which is located below the evaporite formation from which the potash is mined.

The foregoing summarizes the current, proven waste disposal technology employed in the potash mining field. The major problem with this technology is that the huge piles of waste salt will require hundreds of years to dissolve under the influence of natural precipitation. The brine that forms must be contained and disposed of in a satisfactory manner to prevent surface and groundwater pollution.

The storage time can be shortened by augmentation of the process water with additional fresh water to dissolve salt from the pile and injection of the brine into the underground disposal formation. There are some possible

disadvantages to this method aside from additional cost. The method requires additional water, which may not be readily available, and may not be a responsible use of fresh water resources. Another major concern is with respect to the potential risk resultant from the injection of the saturated brine solution into the ground water disposal formation. This risk has not yet been fully assessed. More research is needed to explore this method of brine disposal which has also been utilized in oil field exploration and development.

There are a number of other untried or unproven alternatives for disposal of the salt piles.

Underground Disposal entails the return of the waste salt in a granular form to the underground cavities or "rooms" in the mine. This method may not be practical in a horizontal mine such as the Russell potash deposit Even where this is practical, all of the waste salt cannot be returned to the underground rooms. Another disadvantage is that once all possible back filling of the waste salt has occurred, the balance of the material in the unmined pillars could not be extracted by selective solution mining methods. There would also be an additional cost.

Selective Solution Mining is an experimental but largely untried method of mining by means of which additional potash could be extracted from a mine beyond the conventional method of extraction by mining out "rooms" and leaving support "pillars". The method involves the return of sodium chloride brine into the area that has been mined. By a selective solution process, the saturated sodium salts would be deposited in the mine in exchange for the potassium salts in the unmined pillars. The potassium saturated brine would be returned to the mill where the potassium would then be removed from the solution as the desired product. This method is unproven and therefore uncertain.

Capping of Tailings is a method in which the tailings pile would be covered with soil placed on the surface. The cap would have to be placed in such a manner as to prevent precipitation and resultant surface run-off from

reaching the underlining salt, thus causing migration of the salt away from the containment area. This method would require an enormous quantity of soil and would also be capital intensive. The underlying salt pile would also exist for an indefinite future period.

Burial of Potash Tailings is a method that seems completely impractical because of the size of the hole required and danger of groundwater contamination.

All of the alternative methods cited above would add to the cost of producing potash and, in the examples of capping and burial, the additional costs would be prohibitive. In all other cases, research programs are required to establish that the methodology will work in a specific mining situation, will be cost effective and will protect the environment.

At the hearing, the Commission learned that the Manitoba Department of Energy and Mines had issued a mineral lease to the proponent under authority of the Mines Act that required the proponent to submit a plan to the Department within 5 years that would stipulate measures and programs the proponent would carry out for purposes of protecting the environment from damage as well as for rehabilitation of the lands to a use "consistent with that of the adjoining lands".

In testimony before the Commission the proponent stated that not only was proven technology to be employed but also, because the project was new and could benefit from actual experience in Saskatchewan, additional measures would be taken in the Manitoba operation that would be a subtantial improvement compared to operations in Saskatchewan and elsewhere in the world. These improvements were incorporated into the details of proposed tailings area construction and operation presented to the Commission.

Representatives of the Environmental Control Programs of the Environment Department and the Water Resources Branch (Hydrogeology) agreed that the proposal for tailings containment and operation prepared by the consultants had been engineered in an excellent manner with good improvements

incorporated into the design over and above the Saskatchewan technology. Notwithstanding this, concerns were expressed about the long term security of the containment area and the rehabilitation that had been proposed.

The Environment Department representatives believed that management alternatives for the tailings area and rehabilitative measures to be employed should be submitted by the Company to the Minister for approval prior to the issue of a Stage 2 License.

Conclusions

The Commission concludes that the major environmental issue associated with the potash project is the handling and disposal of the waste salt and subsequent brines that are formed.

The proven technology for management of this has been that employed at most of the Saskatchewan mines. The consultant for the Manitoba potash project proposed the use of this proven technology in connection with the management of the salt pile. In addition, some further improvements and safeguards were proposed.

As long as the salt containment system is maintained, it is believed that the salt brine will be prevented from migrating to the adjoining areas and to surface and groundwaters. However, it would be desireable and more acceptable if, in place of hundreds of years, the salt piles created could be smaller and diminished at a faster rate. This is the basic reason that the Commission has proposed that the proponent undertake studies to examine alternatives for the waste salt management and also identify financial and technical mechanisms to ensure satisfactory management of remaining salt and salt brine during the rehabilitation period. The Commission believes that these tailings management alternatives and rehabilitative measures should be identified and presented for consideration during hearings prior to the issuance of the Stage 3 - operation license for the potash development.

RECOMMENDATIONS

A. Stage 2 License - Development and Construction

1. The Commission recommends that the proponent be required to design and construct its industrial waste facility in accordance with information contained in the documents submitted by Kilborn (Sask) Ltd. dated August, 1987 prepared on behalf of Canamax Resources Inc. and Manitoba Energy and Mines under title "Manitoba Potash Project - Technical and Economic Feasability Study - Volume VI, Environmental" as well as Appendix "A" to Volume VI and a letter of February 17, 1988 from Kilborn Engineering to M. Boreskie of the Department of Municipal Affairs.

   Some of the features documented in the these reports and documented at the Commission hearings that would ensure brine containment includes the following:

   - Use of native clay till for dyke construction with a brine enhanced clay lining and the use of brine enhancement of the clay till to construct a barrier beneath the exterior dykes to the level of the underlying shale such that all of the surfaces of the containment area in contact with the brine will have a soil hydraulic conductivity of 1×10^{-7} cm per sec or less.

   - Construction of a sub-soil drain at the exterior face of the brine enhanced clay barrier at the elevation of the shale layer as a first defence against brine seepage. Collected brine would then be returned to the brine pond.

   - Construction of an external seepage collection ditch and a freshwater diversion ditch.

   - Construction of a contingency containment dyke to take care of emergencies in the event that a dyke is breached.

- Maintenance of a minimum distance of 250 metres from any glacial melt water channels to the waste management system.

- The avoidence of granular soils such as sand lenses within the waste management containment area.

- Provision of a brine return system in the ponds that will maintain the brine level as low as possible consistent with the practical operation of the mill.

- Construction and operation of the brine ponds in a manner that meets the specifications set out in the Canmet Pit Slope Manual.

- Construction and operation of brine pipelines so that pipeline failures will result in the absence of brine migration from the containment disposal area.

- Piling of salt in a manner such that stability of the dykes is ensured. Both the dykes and the tailings pile shall be monitored for stability as necessary to meet the approval of the "director" of the Environment Department.

- Installation of a monitoring system to meet the approval of the "director" of the Environment Department.

- Installation of air emission control equipment satisfactory to the "director" of the Environment Department such that standard Departmental air quality objective limits for air emissions from the operation will be met.

2. A definitive review of the application of alternative tailings management and disposal methods, in whole or in part, should be undertaken with specific focus on the technical, environmental and economic application of these methods as compared to conventional surface tailings disposal. The review should include requirements and costs for post operation management and rehabilitation and should be developed for presentation and review at the Stage 3 licensing hearings.

3. A specific plan should be developed and presented for post operation management and rehabilitation of the proposed surface tailings disposal. The proposed plan should identify a mechanism and responsibility to undertake and fund post operation management and rehabilitation. This plan should be prepared for presentation and review at the Stage 3 licensing hearings.

B. Stage 3 License Considerations - Operation

The Commission recommends that:

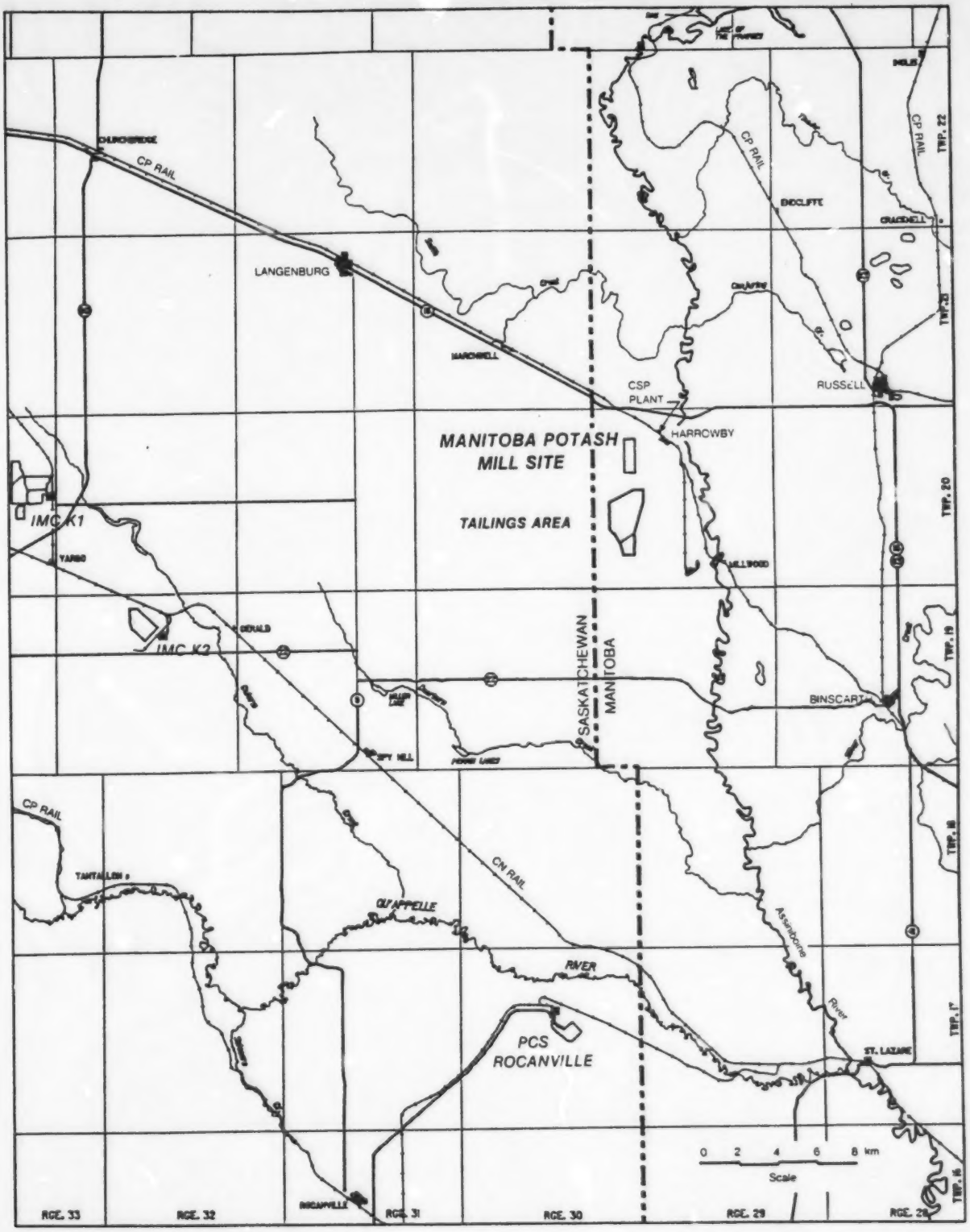
1. All applicable Federal, Provincial and Municipal laws and regulations should be compiled with.

2. Specific requirements for construction, monitoring and discharge of any surface impoundments for solids and/or liquids should be required. Data should be submitted on a regular basis.

3. Specific emission limits should be required for all discharge to the air from the mine and mill operation.

4. Periodic monitoring and submission of air emissions and ambient air data should be required.

5. Contingency plans should be developed and approved to address any type of emergency discharge from, or catastrophic failure of, surface impoundments for solids and/or liquids, and any safety problems that may occur as a result of visibility and icing conditions on nearby roadways.



Site Location

LIST OF EXHIBITS

EXHIBITS SUBMITTED AT RUSSELL, MANITOBA
OCTOBER 25, 1988

1. Honourable Ed Connery, Minister of Environment and Workplace Safety and Health, Letter, dated September 30, 1988.

1.A. Department of Environment and Workplace Safety and Health, Stage 1 Environmental Licence No. 1226, dated September 29, 1988.

2. Canamax Resources Inc., Annual Report 1987.

3. Kilborn (Saskatchewan) Ltd., Manitoba Potash, Technical and Economic Feasibility Study Vol. VI Environmental, dated August, 1987.

4. E & M Drilling Company Ltd., Letter to Mr. Doug Bily, dated November 8, 1985.

4.A. W.M. Ward Technical Services Laboratory, Chemical Analysis Form, water analysis, Mr. D. Bily, dated October 10, 1988.

5. Larry Strachan, Chief, Environmental Control Programs, Environment and Workplace Safety and Health, Canamax Resources Inc. Submission to Clean Environment Commission Public Hearings, dated October 25 - 27, 1988.

5.A. Syd Hancock et al, Community Impact Monitoring Program, Final Report 1985 The Township of Atikokan and Ontario Hydro, dated November 25, 1986.

6. Larry Strachan, Chief, Environmental Control Programs, Environment and Workplace Safety and Health, Memo, "Manitoba Potash Project", dated October 3, 1988 with attachments.

LIST OF EXHIBITS

EXHIBITS SUBMITTED AT WINNIPEG, MANITOBA
OCTOBER 27 & 28, 1988

7. Manitoba Environmental Council, Presentation Concerning The Application By Canamax Resources Limited, dated October 27, 1988.

8. Conservation Strategy Association of Manitoba, Brief - Canamax Resources Inc. Proposed Potash Mining Operation, dated October 26, 1988.

9 Dave Wotton, Head, Terrestrial, Standards and Studies, Environment and Workplace Safety and Health, Speed Memo dated October 27, 1988 with attachments, subject "Vegetation Damage from Salts in Dustfall of Potash Mines".

10 W.A. Bardswich, Director, Mines Branch, Memoandum, dated October 27, 1988.

11. Lease agreement between Her Majesty the Queen and Manitoba Potash Corporation, dated August 14, 1980.